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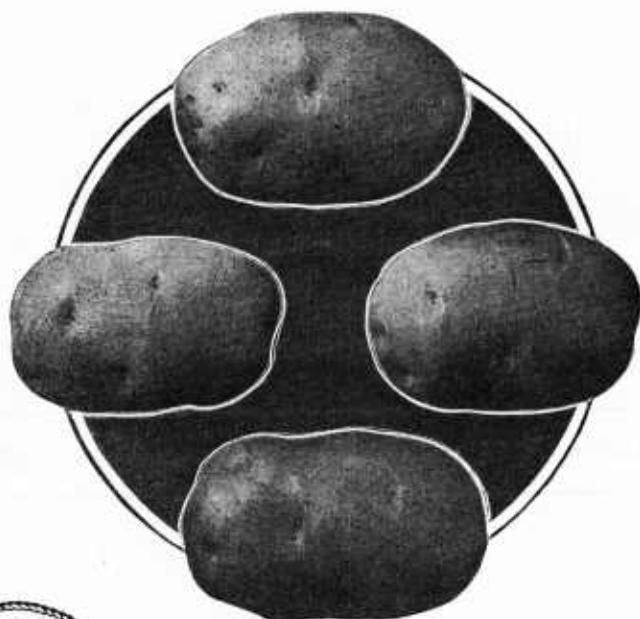
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U. S. DEPARTMENT OF AGRICULTURE

FARMERS' BULLETIN No. 1332

SEED POTATOES AND HOW TO PRODUCE THEM



THE IMPORTANCE of planting good seed potatoes is not appreciated as fully as it should be. Good seed is one of the determining factors in profitably producing maximum crops of potatoes.

The quality of the seed can be improved by removing all diseased, weak, or off-type plants as soon as they are observable.

Good seed can be produced only by giving the growing plants good cultural attention.

Only seed from productive plants should be used. Seed should be free from varietal mixture and true to type.

Good storage conditions are essential in insuring sound, firm seed at planting time.

All seed stock should be disinfected before it is planted.

This bulletin is a revision of and supersedes Farmers' Bulletin 533, Good Seed Potatoes and How to Produce Them.

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SEED POTATOES AND HOW TO PRODUCE THEM

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IMPORTANCE OF GOOD SEED

THE USE OF GOOD SEED is especially important in lowering the unit cost of potato production. Lowering unit cost does not necessarily mean lowering the quality or the price of a bushel of potatoes, but, rather, furnishing a better product without increasing the cost of its production. The progressive potato-grower's aim should be to produce as many profitable bushels per acre as possible.

Two factors determine the quality of seed potatoes: (1) The physical or outward appearance of the tubers and (2) the heritable or transmissible characters of the stock. The first involves the purity and maturity of the stock, uniformity in size and shape of the tubers, brightness of skin, firmness of flesh with first sprouts just showing, and freedom from scab, Rhizoctonia, late blight, or other tuber-decay diseases. The second factor deals with nonobservable characters and is by far the more important, as it involves the presence or absence of the virus diseases causing mosaic, leaf roll, spindle tuber, streak, and yellow dwarf. Freedom from the virus diseases is important and can only be assured by inspection of the growing plants from which the seed was obtained or by the purchase of reliably certified stock.

DEVELOPMENT OF HIGH-GRADE SEED

SELECTION METHODS

The chief improvement to be made in seed-potato stocks by selection methods is the elimination of diseased and weak plants and of varietal mixtures. Experimental evidence seems to indicate that the possibilities of improving seed stock by selective practices alone are not so great as has been claimed, and that the chances of finding superior-yielding, true-to-type strains within a variety are more limited than was once believed.

Five methods of improvement may be used in obtaining a commercially desirable strain of potatoes: (1) The tuber-indexing method, (2) the tuber-unit method, (3) hill selection, (4) mass selection, and (5) field roguing.

TUBER-INDEXING METHOD

The tuber-indexing method of seed-potato improvement is the most recently devised and most effective method of eliminating diseased, weak, and low-yielding potato tubers from seed stock intended for planting in the seed plot. The work is usually done during the winter. The first step is to select as many tubers, each weighing from 7 to 9 ounces or thereabouts, as greenhouse, hotbed, or outdoor space will accommodate. The next step is to number each tuber for identification and then remove a seed piece or set from each, preferably from the seed end, although any strong eye will serve. This set is then put in a suitable-sized pot (the $3\frac{1}{2}$ or 4 inch size is satisfactory), or it may be planted in a greenhouse bench or hotbed. In either case the set must be labeled with the number of the tuber from which it was taken. The plants produced from these seed pieces are carefully observed for virus diseases such as the various types of mosaic, leaf roll, spindle tuber, giant hill, and the yellow dwarf. All plants showing any of these diseases or any sign of weakness are noted, and the seed tubers from which the sets were taken are discarded. In this way it is possible to get rid of most if not all of the diseased tubers before planting them.

The best method of handling the mother tubers from which the index sets have been removed is to hold them for 10 days to 2 weeks in a temperature of 60° to 70° F., after which they may be held at 40° to 45° until planting. The higher temperature with relatively high humidity favors thorough healing of the cut surface.

The extent to which this work can be done in the North, except in regions where a late or fall crop of potatoes can be grown, is necessarily limited to the greenhouse or hotbed space available. Where a fall or second crop is grown, as in southern New Jersey, the Eastern Shore of Maryland and Virginia, and practically all of the Southern States, it is possible to practice the tuber-indexing method with the spring crop by planting the set from the numbered tuber in the open field and properly labeling it. Observations can be made during the growing season in ample time for a second-crop planting of indexed tubers that are apparently free from disease as well as from any inherent weakness. By doing such work in the far South it would be possible to grow the indexed sets to full maturity before the normal planting period in the North. In fact, certain State seed-certification agencies are now resorting to this practice in order to get a "reading" on the behavior of their certified strains of seed potatoes. At the usual planting time, the tubers found to be free from disease are planted in a seed plot by themselves, the pieces from each tuber being planted separately. It is then easy to identify, in the growing plants, any disease from an infected tuber that may have escaped the observer of the tuber-index set. From this point in the process the practices are the same as those under the tuber-unit method.

TUBER-UNIT METHOD¹

The tuber-unit method consists in selecting from the seed bin before planting time a considerable number of the most perfectly shaped tubers ranging from 6 to 8 ounces in weight. In planting, these tubers are quartered, as dropped, into parts as nearly equal as possible, by splitting the bud-eye cluster twice from seed to stem end of the tuber. In other words, the tuber is cut through its longitudinal axis. The four pieces of each tuber are dropped consecutively in the row, 10 to 12 inches apart. All tubers showing discoloration of the flesh or other evidence of disease should be rejected. By allowing an additional spacing between sets of fours, the four plants from each tuber are definitely isolated and the grower can readily observe any variation in vigor and uniformity among the various units planted. This method also enables him to detect any mixtures in the variety. All mixtures should be removed at once. The units that appear most uniform in size, vigor, and type when the plants are still in vigorous growth are marked, and the first step in selection has been accomplished. At digging time the product of each unit is separately harvested and a further selection made from the marked units of all tubers which most nearly approach the size, shape, and smoothness desired. The selected tubers of each unit should be separately placed in small sacks, preferably cotton or burlap, numbered with both field and unit numbers, and stored to await further examination. The final examination should produce data on the number and weight of merchantable and unmerchantable tubers and their general conformity in size, shape, and smoothness to the type desired. From each of the units retained 10 of the best tubers should be selected for the next season's planting.

It is desirable to maintain the study of each selection on the tuber-unit basis the following season, because it permits a more accurate comparison of the behavior of each. The 10 selected tubers from each original unit will give 40 plants for study the second year. All selections which do not produce a reasonably uniform lot of plants should be rejected. At harvest time the progeny of each selection should be kept by itself and the same data recorded as those taken on the crop grown from the original tuber unit. Only the products from such 40-hill rows as meet the most rigid requirements should be retained. The further work will consist in multiplying the selected strains for field planting and eliminating the weak plants.

HILL SELECTION

The hill-selection method consists in marking the most promising plants during the growing season and at harvesting time saving only the progeny of the best. (Figs. 1 and 2.) The progeny of each hill should be kept separate and the same data taken as outlined for the tuber unit. Plant on the tuber-unit or progeny-row basis the following season. For the sake of uniformity a definite number of tubers (five or more) from each hill selection should be planted. Subsequent procedure should follow the practices given for the tuber-unit method.

¹ For further information on the arrangement of a tuber-unit selection plot and a convenient system of note taking, see U. S. Dept. Agr., Bur. Plant Indus. Circ. 113, The "Tuber-Unit" Method of Seed-Potato Improvement.



FIGURE 1.—Progeny of (A) a mosaic-infected potato plant of the Triumph variety and (B) a healthy plant. Bin selection of such seed would result in taking at least two tubers from the mosaic plant. If small tubers were used all would come from diseased plants. In hill-selection work only the progeny of plant B would be saved.

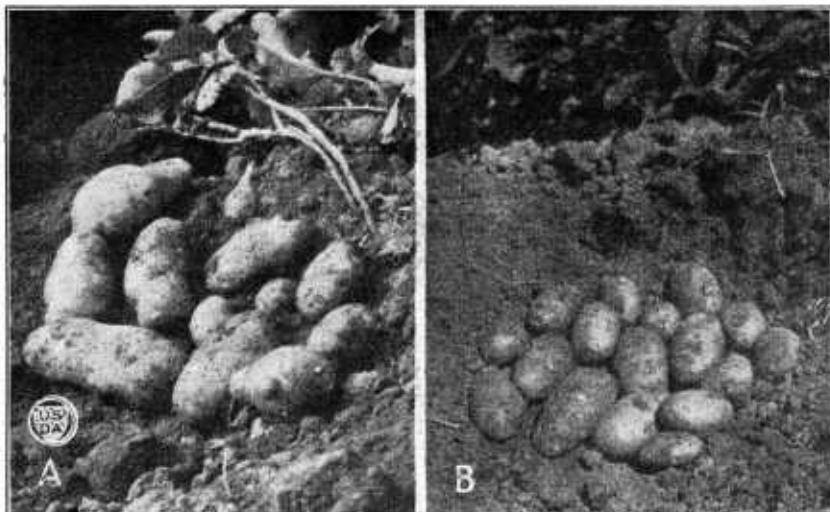


FIGURE 2.—Progeny from (A) abnormal and (B) normal plants of the Russet Burbank potato. Plant A is known in the West as a degenerate or run-out plant, and the disease with which it is affected is probably identical with that termed "spindle tuber." It is a communicable disease and may become serious. In hill-selection work only the progeny of plants such as B would be saved.

MASS SELECTION

Mass selection differs from hill selection in only one respect, that is, the tubers from the individually selected plants are not kept separate. Generally growers who practice mass selection do not go to the trouble of marking promising individual plants during the growing season, but simply go through the field before harvesting the whole crop and dig by hand as many plants that show the desired vigor and stem characters thought to be correlated with productivity, trueness to type, and uniformity in size of tubers of the particular variety grown, as may be desired to secure the necessary quantity of seed.

FIELD ROGUING

By "roguing" vegetable-seed growers mean improving the seed stock by the process of removing all "rogues"—diseased, weak, off-type, or varietally mixed plants—from the field or seed plot during the growing season, when the process is relatively easy. Roguing does not necessarily require an intimate knowledge of the various potato diseases, but it does call for the ability to tell whether a plant is normal or abnormal in appearance. Varietal mixtures are more easily detected when the plants are in bloom. Weak plants are usually easy to detect in the early stages of their growth, as are also certain types of disease such as mosaic and blackleg, although both weakness and disease may appear later. Infection with Rhizoctonia and Fusarium is usually not apparent until the latter part of the growing season. The area should be gone over at least three times during the growing season. In field roguing a sufficient area should be covered the first year to provide enough seed to plant the full acreage that is to be grown the ensuing season. When the crop of the seed plot is harvested, further roguing should be done by discarding the progeny of all low-producing plants. (Fig. 1, A.)

RELATIVE MERITS OF THE DIFFERENT METHODS

Careful consideration of all the experimental evidence at hand seems to justify the conclusion that in the hands of an especially trained individual the tuber-indexing method is without doubt the most effective process for eliminating diseased tubers and for creating foundation stock from which to produce high-class seed stock. The tuber-unit method is the next most promising. When it is practiced in connection with hill selection it should prove much more effective than when used in connection with bin-selected stock. The first three methods can be recommended only to those growers and specialists who are capable of giving the thought and time necessary to produce results. Mass selection and field roguing present greater possibilities in the hands of the average grower who does not have time or inclination to give the care required for best results.

The only requirements for the successful practice of the tuber-unit, hill-selection, and mass-selection methods are a reasonable degree of painstaking effort on the part of the grower, some 12-inch garden labels, a small pair of balances, a sufficient number of small sacks, a safe place in which to store the selected tubers until they are required for the next season's planting, and a breeding plot in which each season's selections can be developed into planting stock. The selection

or seed plot should be located as far from the commercial potato field as possible, in order to secure the greatest degree of isolation feasible.

ISOLATION

It is now recommended that in producing seed potatoes under isolation, each variety be grown separately, because it has been found that stocks of certain varieties supposed to be free from mosaic have served as carriers of disease to more susceptible varieties. For example, it is not desirable to grow the Irish Cobbler adjacent to the Green Mountain intended for certification, as the former may carry the mosaic virus without revealing it. Some seed-certification agencies consider the danger of the Irish Cobbler's contaminating the healthy Green Mountain variety so great that they refuse to certify Green Mountain stock near which Irish Cobbler has been grown. The ultimate success in using the isolated seed plot in eliminating tuber-borne diseases rests largely on the ability of the grower to recognize diseased plants and his promptness in removing them from the seed plot and destroying them. Heretofore, the factor of isolation has not received due consideration, largely because the seriousness of such diseases as mosaic, leaf roll, curly dwarf, streak, and spindle tuber had not been recognized. The fact that all of these diseases are readily transmitted from diseased to healthy plants through the instrumentality of plant lice or aphids and the further fact that as yet there is no reliable information on the distance over which insects may transport these diseases, suggest an isolation of the seed plot as complete as possible.

Frequent and thorough inspections of the seed plot are necessary to insure the largest possible elimination of diseased plants and to reduce the transmission of disease from diseased to healthy plants.

SEED TREATMENT

It is impossible to produce high-grade seed potatoes if the seed planted is infected with disease organisms capable of infecting the crop. Disinfection of the seed potatoes is therefore necessary if the best results are to follow. The two diseases for which seed potatoes are ordinarily treated are common scab and black scurf, or Rhizoctonia. The two disinfecting agents recommended for such treatment are formalin and corrosive sublimate (mercuric chloride, or bichloride of mercury). Formalin is a trade name for a 40 per cent solution of formaldehyde gas. Corrosive sublimate is a white crystalline poisonous compound which goes into solution very slowly in cold water but is readily dissolved in boiling water. The hot-formaldehyde treatment of seed has been found much more effective against black scurf (Rhizoctonia) than the cold-solution treatment, and requires a much shorter period of immersion. The formulas recommended for these two disease disinfectants are:

1. Formalin:
 - a. Cold treatment:
Formalin, 1 pint.
Water, 30 gallons.
 - b. Hot treatment:
Formalin, 2 pints.
Water, 30 gallons, heated to
125° F.
2. Corrosive sublimate, 4 ounces.
Water, 30 gallons.

The period of treatment for formula 1, *a*, and for formula 2 is from $1\frac{1}{2}$ to 2 hours when the seed is dormant and one-half to $1\frac{1}{2}$ hours if the tubers are germinated. With formula 1, *b*, on account of the double strength of the solution and the higher temperature of the liquid, the period of treatment is cut to 4 or 5 minutes. In using the hot formaldehyde solution it is necessary to have a reliable thermometer and a well-controlled method of maintaining a uniform temperature throughout the treatment.

The treated tubers should on no account be allowed to come in contact with such receptacles as sacks and barrels in which diseased seed has been handled, as these articles are almost certain to be sources of reinfection.²

SOIL PREPARATION AND CULTURAL PRACTICES

Strong, vigorous plants can not be produced on land that has been poorly prepared or that is deficient in available plant food. Seed potatoes should be grown on land that has been deeply plowed and thoroughly prepared to receive the seed. It should be well supplied with organic matter and available plant food. A clover or alfalfa sod furnishes the organic matter and considerable plant food. Barnyard manures or commercial fertilizers, or both, will supply the additional plant food necessary.

The vigor of the seed stock produced depends largely on the care given to the growing crop. Uniformity in the size of the tubers is largely governed by the rate of planting. Closer planting should be practiced in growing seed than in growing table stock. Some growers in Aroostook County, Me., space their rows 32 to 36 inches apart and the plants in the row 8 to 12 inches. The crop should be cultivated as frequently as may be necessary to provide the most suitable growing conditions.

The plants should be sprayed to prevent injury by insect or fungous pests. Leaf-eating insects can be effectively controlled by thorough spraying with arsenical poisons; sucking insects, with contact solutions, such as kerosene emulsion and nicotine; and fungous diseases, such as the early and late blights, with Bordeaux mixture. In every operation it should be remembered that whatever contributes to the health of the plant increases the vigor of the seed stock produced.

IMPORTANCE OF TUBER SHAPE AND SIZE

Reasonable trueness of the tubers to varietal type is generally demanded by the purchaser of certified seed. The Irish Cobbler grower in the South demands roundish tubers and is suspicious of the purity of seed stock that contains flattened and somewhat elongated tubers; he generally protests against accepting them as strictly first-class seed stock, and is inclined to regard the off-type tubers as Green Mountain.

However, some scientific workers and practical growers are now disposed to regard tuber shape as being less important than was previously supposed. They have come to regard tubers that have departed from the type because of unfavorable environmental conditions as being satisfactory for seed purposes, and as no more likely

² For more complete information on seed treatment, see U. S. Dept. Agr. Misc. Pub. No. 52, *Disinfecting Seed Potatoes*.

to produce off-type progeny than are normal-shaped tubers. This, however, does not apply to tubers that are off-type as a result of disease; such tubers should not be planted. The spindle tuber, now recognized as a communicable disease, is very similar to leaf roll and the mosaic disease in its method of transmission. Figure 2, A, pictures a fairly good example of spindle tubers. It is important, therefore, in purchasing somewhat off-type seed potatoes to know that the change in shape is really due to unfavorable environmental factors and not to disease.

In seasons of short production and consequent high prices for table stock, the question of whether it is advisable to use the small, unsalable tubers for seed is frequently raised. It is always unsafe to use small tubers for seed unless it is absolutely certain that they have been produced by healthy, vigorous, and productive plants. It is never advisable to use small tubers from the general production from unselected stock. Some experimental study of this subject by Ballou and Gourley³ demonstrated that the planting of large tubers gave—

- (1) A very high, sometimes almost total, percentage of the high-producing strains.
- (2) A high percentage of the average or moderate-yielding strains.
- (3) A very low percentage of the inferior or low-producing strains.

The planting of small tubers gave—

- (1) A very insignificant percentage of the high-producing strains.
- (2) A low percentage of the moderate-yielding strains.
- (3) A very high, almost total, percentage of the low-yielding strains.

WHOLE SEED COMPARED WITH CUT SEED⁴

Experimental evidence does not indicate that whole tubers are better than cut tubers as seed, at least in the United States. The data, while conflicting, show that in general and with reasonable limits the larger the seeds planted, the larger the crop. If whole seed is to be planted, small tubers and those from unselected stock should not be used.

The tubers should be germinated before being planted, to insure a minimum number of sprouts. Planting dormant whole tubers causes too many sprouts to develop.

HARVESTING AND STORAGE

The importance of preventing mechanical injury of the tubers during harvesting and storing is not fully realized. If the land contains small stones, the tubers are almost certain to be more severely injured in harvesting than if they were grown in a sandy loam soil. Hand digging is not always feasible, but where small stones abound in the soil it is desirable to harvest the home seed plot by hand.

Much injury will be avoided if, when harvested, the seed stock designed for planting the field plot of the ensuing year is placed directly in crates in which it can remain throughout the storage period.

³The Status of the Potato-Growing Industry in Ohio. II. Seasonal Notes on Potatoes. Ohio, Agr. Exp. Sta. Bul. 218.

⁴Size of Potato Sets: Comparisons of Whole and Cut Seed. U. S. Dept. Agr. Bul. 1248.

The storage conditions necessary to insure vigorous seed at planting time are more easily provided in the North than in the South, because it is easier to maintain the proper temperature in that region. In the North a well-constructed cellar, pit, or cave serves reasonably

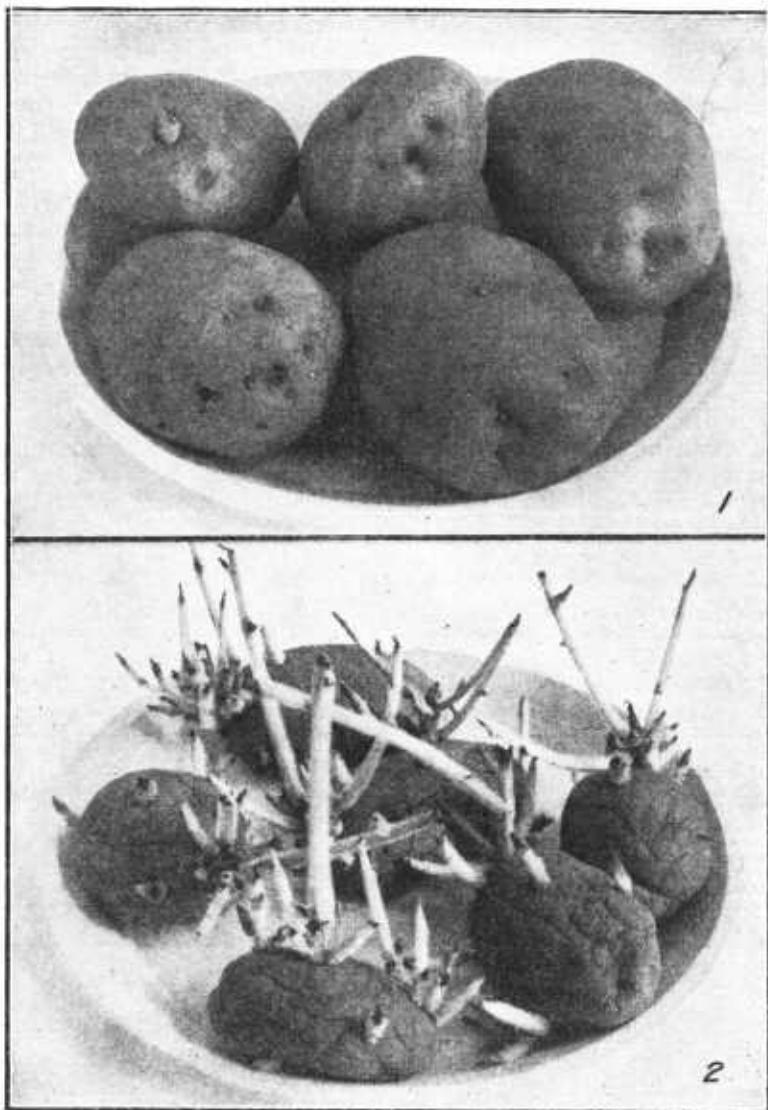


FIGURE 3.—Potatoes to be used for seed, showing different stages of germination:
1, Desirable; 2, undesirable

well. The main requirement is to keep the room temperature low enough to retard germination. The ideal seed tuber is one that has not wasted any of its stored-up energy by excessive loss through sprouting. (Fig. 3.) It should be firm, with the first sprouts just

showing. Such tubers can be depended upon, under suitable conditions, to start quickly when planted and to make a vigorous growth.

In the South, because of the difficulty in preserving proper storage temperatures and thus preventing sprouting, the general practice has been to secure seed stock from the North. This method has difficulties also, because there is always the risk of the seed being chilled, frozen, or overheated while in transit in midwinter. Proper storage facilities such as described in Farmers' Bulletin 847, Potato Storage and Storage Houses, would allow the southern potato grower to have his seed stock shipped to him as soon as it is harvested in the fall or even to grow his own seed if he desires.

CERTIFICATION OF SEED

The rapid increase in acreage and production of certified seed potatoes, and the higher prices which their growers demand, have made it necessary to demonstrate that certified seed potatoes are superior to ordinary seed potatoes. During the time when the production of certified seed was being developed, there was not enough experimental evidence to support the growers' claims of its superiority. But now there is abundant evidence of that superiority. Data covering actual comparative tests made by a large number of independent investigators are shown in Table 1, taken from an address by H. C. Moore before the 1924 annual meeting of the Potato Association of America.

TABLE 1.—*Comparative tests of potato yields, showing the advantage of using certified seed*

Location of tests	Tests or reports	Average increase in yields per acre	Location of tests	Tests or reports	Average increase in yields per acre
	Number	Bushels		Number	Bushels
Canada (8 Provinces)-----	15	88	Michigan-----	314	73
Connecticut-----	144	53	Missouri-----	46	43
Delaware-----	21	83	Montana-----	2	219
Illinois-----	15	47	Nebraska-----	64	141
Indiana-----	9,740	44	New York-----	68	76
Kansas-----	11	41	Ohio-----	168	48
Kentucky-----	220	42	Oregon-----	3	150
Louisiana-----	31	42	Pennsylvania-----	87	41
Maine-----	279	83	South Carolina-----	8	31
Massachusetts-----		75			

REQUIREMENTS

Seed certification is a system of official inspection whereby the quality of the potato-seed stock may be guaranteed. At present potato-seed certification is being carried on in 22 States and in every Canadian Province.

It is purely voluntary on the part of seed-potato growers in the States and Provinces in which the service is available. In many States, however, the applicant for seed certification must previously have submitted to the official in charge of the certification work a sample of the seed stock he proposes to plant, or he must plant certified seed approved by that official. A number of States also require that an isolated seed plot be maintained.

All seed-potato certification agencies have promulgated rules and regulations designed to insure a high degree of freedom from disease. Practically all these agencies require that two field inspections of the growing plants and a subsequent examination of the tubers at the bin or shipping point be made by their authorized inspectors before they will issue certification tags. This procedure guarantees the purchaser and user that such seed is free from any appreciable amount of tuber-borne diseases, especially those of the virus type. While there are differences in the percentage of disease tolerated in the different seed-producing States, they are not sufficiently great to materially affect the quality of the seed. Certain requirements as to trueness to name, freedom from varietal mixture, vigor of plants, yield, tuber type, percentage of mechanical injuries, etc., are also made in seed certification. The personal factor is generally recognized as of greater importance than rigidity of rules and regulations.

The producer of high-grade seed potatoes is justly entitled to a fair monetary return for the special efforts he has made to produce high-quality seed stock, especially if he has maintained a seed plot year after year and his crop has been officially inspected and passed by an authorized seed-certification inspection officer.

VOLUME OF PRODUCTION

The extent of the seed-potato certification movement and the volume of production are indicated by Table 2, which gives for 1923-1932 the production, in bushels, of certified seed potatoes in the 22 States in which seed certification has been undertaken. The volume of production during the last half of the decade shows an average increase of more than 45 per cent over that of the first five years. The year of greatest production was 1928, in which over 10,250,000 bushels were certified.

TABLE 2.—*Production of certified seed potatoes (bushels) in 22 States, 1923-1932¹*

State	1923	1924	1925	1926	1927
California			12,050	12,075	17,800
Colorado		22,037	28,560	31,300	77,105
Idaho	92,500		278,148	371,479	866,162
Kentucky	3,200	7,550	14,622	22,920	25,500
Maine	2,140,875	5,052,681	2,226,050	2,294,845	3,278,101
Maryland	7,000		8,205	18,390	32,078
Michigan	272,794	291,086	214,656	337,000	162,397
Minnesota	511,588	777,800	596,605	693,685	621,999
Montana	14,374	31,950	67,800	113,365	180,562
Nebraska	192,880	79,750	121,200	60,200	181,500
New Hampshire	15,183	30,328	12,287	2,695	14,778
New Jersey	23,100	81,850	57,911	92,916	2,475
New York	239,031	363,065	210,700	225,371	323,080
North Dakota	72,663	101,836	171,110	181,400	321,305
Ohio	11,025	11,230	4,120	5,600	6,300
Oregon		15,900	27,600	46,000	87,840
Pennsylvania	52,151	65,000	25,965	41,115	29,870
South Dakota			23,600	28,441	49,856
Vermont	127,500	225,000	108,655	160,031	252,582
Washington	28,760		17,550	30,300	121,350
Wisconsin	387,875	357,074	163,025	196,500	245,000
Wyoming	70,000		21,000	138,000	259,500
Total	4,262,499	7,514,137	4,411,419	5,103,628	7,153,140

¹ Data supplied by the Bureau of Agricultural Economics, U. S. Department of Agriculture.

² The second crop developed primary leaf-roll symptoms and nearly all fields were rejected.

TABLE 2.—*Production of certified seed potatoes (bushels) in 22 States, 1923-1932—Continued*

State	1928	1929	1930	1931	1932
California.....	12,000	11,768	4,200	8,750	(^a)
Colorado.....	57,890	71,450	51,945	95,580	122,530
Idaho.....	349,509	203,717	314,803	224,232	161,480
Kentucky.....	8,754	21,117	9,050	9,088	11,800
Maine.....	5,094,128	3,998,902	2,709,554	4,628,780	2,920,669
Maryland.....	21,581	40,488	16,808	65,948	57,408
Michigan.....	854,742	741,215	212,125	193,642	370,664
Minnesota.....	1,162,540	911,099	548,291	662,528	437,266
Montana.....	236,499	72,380	68,962	62,142	63,965
Nebraska.....	152,400	462,450	663,000	384,000	392,001
New Hampshire.....	17,250	9,264	34,960	39,650	12,925
New Jersey.....	100,355	62,286	49,666	109,177	75,406
New York.....	470,528	572,100	715,835	819,220	557,950
North Dakota.....	539,855	412,300	372,000	413,000	824,620
Ohio.....	6,150	6,400	4,800	6,000	7,000
Oregon.....	154,237	137,711	74,050	136,635	188,210
Pennsylvania.....	60,490	69,760	46,016	91,113	103,197
South Dakota.....	59,309	59,206	27,790	35,350	40,175
Vermont.....	136,119	136,531	132,850	219,140	177,886
Washington.....	81,825	76,900	85,085	115,363	93,301
Wisconsin.....	448,400	293,360	261,391	258,596	172,900
Wyoming.....	350,000	185,500	299,780	187,338	130,935
Total.....	10,374,561	8,555,904	6,702,961	8,765,272	6,929,058

^a Data not available.

Maine has easily been the leader in volume of production.

Figures on the production of certified seed of 10 of the leading commercial varieties in the United States, as given in Table 3, show that the Irish Cobbler, Green Mountain, and Triumph varieties lead in number of bushels certified.

TABLE 3.—*Production of certified seed potatoes (bushels) in the United States, by varieties, 1923-1932¹*

Variety	1923	1924	1925	1926	1927
Irish Cobbler.....	942,893	2,402,126	1,402,587	1,969,042	2,262,239
Triumph.....	490,600	368,764	302,255	418,546	976,826
Spaulding Rose.....	207,141	1,060,194	453,918	595,647	597,430
Early Ohio.....	238,708	327,795	181,691	172,263	153,478
Burbank.....	7,016	5,100	16,100	18,100	38,955
Russet Burbank (<i>Netted Gem</i>).....	90,917	53,975	446,016	529,157	1,026,592
Green Mountain.....	1,660,998	2,619,560	1,052,032	798,917	1,571,267
Charles Downing (<i>Idaho Rural</i>).....	29,200	—	38,458	13,958	52,398
Rural New Yorker No. 2.....	263,444	224,898	131,084	541,882	134,196
Russet Rural.....	363,538	342,490	213,982	346,454	200,675
Variety	1928	1929	1930	1931	1932
Irish Cobbler.....	3,562,126	2,593,869	1,843,473	2,945,996	2,203,335
Triumph.....	1,337,496	1,233,769	1,157,980	939,113	1,003,269
Spaulding Rose.....	791,995	483,539	410,280	577,772	221,994
Early Ohio.....	224,653	186,967	182,279	280,528	366,454
Burbank.....	68,288	82,092	30,330	40,533	26,690
Russet Burbank (<i>Netted Gem</i>).....	550,721	313,961	439,593	384,179	343,139
Green Mountain.....	2,479,174	2,230,965	1,679,078	2,722,315	1,635,714
Charles Downing (<i>Idaho Rural</i>).....	15,085	14,276	15,883	6,425	6,901
Rural New Yorker No. 2.....	261,571	268,074	243,042	237,739	223,940
Russet Rural.....	925,826	894,933	414,797	451,169	594,929

¹ Data from the Hay, Feed, and Seed Division, Bureau of Agricultural Economics, U. S. Department of Agriculture.

RESTRICTED USE

It is obvious from the foregoing information on the value of certified seed potatoes and the extent of their production that growers of potatoes for either commercial or home use are not yet fully convinced of the advantage of planting certified seed.

Even after more than 15 years of seed certification less than one-fourth of the total potato acreage of the United States is planted with certified seed. The reason for this seeming neglect by growers may well be considered. The data in Table 1 clearly show a distinct gain in yield, ranging from 31 to 219 bushels an acre, from the use of certified seed. Obviously, failure to use certified seed can not be ascribed to lack of performance of the seed in increasing yield.

Two factors are probably involved in this failure: (1) Price difference between certified and uncertified seed; and (2) indifference of the grower to quality of seed. In regard to the first factor, purchasers of certified seed may consider that many growers demand a larger price premium than is warranted. However, the price premium is partly justified by the exacting demands of the purchaser in regard to freedom of the tubers from mechanical injuries, from surface diseases such as common scab and rhizoctonia, and from undersized and oversized potatoes. To meet purchasers' requirements the grower must often discard a considerable percentage of his stock, thereby reducing his profits. In order to reduce such grading losses the grower must select land as free from scab and rhizoctonia infestation as possible; he must control the size of tubers by closer planting or the use of larger seed pieces, and he must lessen mechanical injury by more careful harvesting and handling.

By observing such practices the grower can lessen materially the percentage of the crop that fails to come within grade requirements and thereby remove the necessity for demanding a seemingly high premium for his seed stock.

The use of bogus seed-certification tags has also seriously curtailed the use of certified seed, because of the poor performance of stock so tagged and the failure of the purchaser or user to recognize that it was not bona fide certified seed. The would-be purchaser of certified seed should learn to distinguish between genuine and bogus seed-certification tags.

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